

REMARKS

By the present amendment, claims 1 and 19 have been amended to clarify certain features of applicant's invention. Upon entry of this amendment, claims 1-15 and 19-28 will be pending in the application, with claims 11-15 and 26-28 being withdrawn from consideration.

Claim Rejections - 35 U.S.C. §103

Claims 1-10 and 19-25 have been rejected as being obvious over prior art admitted in applicant's specification in view of U.S. Patent No. 4,606,959 to Hillinger, either alone or in combination with other secondary references.¹

Applicant's invention is directed towards providing an aircraft heated floor panel wherein the metal face sheet may be secured to the underlying composite structure during a high temperature curing step. In background of the invention, it was explained that:

An aircraft heated floor panel is usually made by compiling a series of layers together to form a lower support level and an upper heater level. The lower support level may include, for example, a honeycomb layer surrounded by reinforcing fiber layers. The upper heater level may include, for example, a resistance element disposed in layers of a thermosettable dielectric material. High temperature film adhesives and scrims are appropriately provided between the layers and the compiled layers are cured at an elevated temperature (often in excess of about 250° F) to form a composite structure.

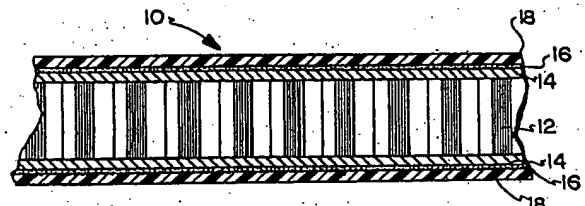
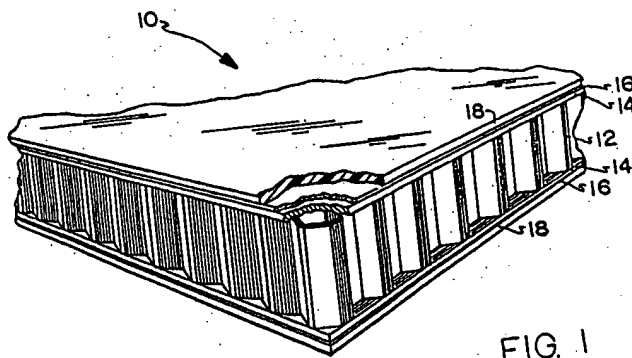
The composite structure is then cooled to room temperature and the metal face sheet is secured to the previously cured layers in a separate manufacturing step. Specifically, for example, an epoxy cross-link adhesive may be used to bond the metal face sheet to the top of the heater. The secured metal face sheet may then be cut/trimmed to the correct size and an appropriate surface

¹Specifically, claims 1-3, 6-7, 9-10 and 19-24 have been rejected as being obvious over the admitted prior art in view of Hillinger; claims 4 and 5 have been rejected as obvious over the admitted prior art in view of Hillinger and further in view of U.S. Patent No. 3,697,728 to Stirzenbecher; and claims 8 and 25 have been rejected as being obvious over the admitted prior art in view of Hillinger and further in view of U.S. Patent No. 4,804,569 to Arisawa.

treatment (e.g., paint, primer, anodizing, etc.) may be applied.²

Prior to applicant's invention, securing the metal face sheet to the underlying composite structure during a high temperature curing step was not possible due to the differences in the thermal expansion rates between the support/heater layers and the metal layer.³

The Examiner contends that "bonding protective sheets to honeycomb composite panels with pressure-sensitive adhesives is well known in the art" and cites Hillinger in support of this contention. Hillinger discloses a honeycomb panel 10 that is capable of being formed into free-standing shapes so that it can be used as a trade show exhibit or display panel. The panel 10 comprises a honeycomb core 12, paper (e.g., kraft paper or paperboard) facing sheets 14 which close the open ends of the honeycomb cells, thin layers 16 of pressure-sensitive adhesive material, and rigid light-weight plastic sheet material 18 which "form the outer layers of the panel for a variety of purposes." (See Hillinger Figures 1 and 2, below.)



²Applicant's specification, page 1, lines 14-27.

³Specifically, at the high temperatures necessary to cure the support/heater layers, the metal face sheet would expand outwardly at a greater rate than the support/heater layers. If a high temperature film adhesive was used to secure the metal face sheet to the underlying support/heater layers, such an adhesive would lock the metal face sheet in this expanded condition. As the panel was subsequently cooled to room temperature, the bonded metal face sheet would attempt to contract inwardly thereby causing gross warping of the sheet.

Hillinger teaches that the outer layer 18 should be “a rigid, moderately expanded polyvinyl chloride (PVC) sheet having a foamed center and a thin skin having a smooth matte outer surface on either side.” The reference strongly cautions that “[i]t is very important” to use such a rigid light-weight plastic material as “[o]ther plastic sheet materials . . . have been tried without success” In fact, the patent specifically states that the desired “combination of properties is just simply not obtained if another material is used instead of moderately expanded rigid PVC as the outer layer 18.”

It is respectfully submitted that Hillinger teaches, at the very most, that a pressure sensitive adhesive can be used to bond a particular plastic sheet 18 (*i.e.*, a rigid, moderately expanded PVC sheet having a foamed center and a thin skin having a smooth matte outer surface on either side) to a paper layer on a honeycomb panel. It does not show or suggest that such an adhesive should or could be used to bond a metal face sheet to a honeycomb composite panel. In fact, Hillinger teaches that the desired results would “just simply” not be obtained with such a substitution.

Moreover, the “elevated” storage temperatures (*e.g.*, up to 140° F) encountered by the Hillinger trade show displays are well below the elevated curing temperatures (*e.g.*, in excess of about 250° F) experienced by an aircraft heater panel. By the present amendment, independent claim 1 has been amended to set forth that the pressure sensitive adhesive retains elasticity after bonding and performs during elevated curing temperatures in excess of about 250° F. Independent claim 19 has been amended to clarify that the elastic adhesive performs during elevated curing temperatures in excess of about 250° F.

The “admitted prior art” and/or Hillinger do not show or suggest using such an adhesive in an aircraft heated floor panel. The secondary references do nothing to cure this discrepancy. Whatever Stirzenbecher may teach about aluminum plates, and/or whatever Arisawa may teach regarding rubber-based adhesives, they provide absolutely no indication that the Hillinger adhesive techniques could be used with metal face sheets and/or at during elevated curing temperatures in excess of about 250° F. With particular reference to claims 19-25, the applied art also does not show or suggest that the accommodation of different rates of thermal expansion during curing procedures.

Conclusion

In view of the foregoing, this application is believed to be in a condition for allowance and an early action to that effect is earnestly solicited.

Respectfully submitted,

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Amendments to the Claims

1. (Currently Amended) An aircraft heated floor panel, comprising:
a plurality of layers cured together to form a lower support level and an upper heater level;
a metal face sheet for protecting the top of the panel from floor-traffic related damage; and
a pressure sensitive adhesive bonding the metal face sheet to the underlying support/heater layers;
wherein the pressure sensitive adhesive retains elasticity after bonding and performs during elevated curing temperatures in excess of about 250° F.
2. (Original) An aircraft heated floor panel as set forth in claim 1, wherein the support layer includes a honeycomb layer sandwiched between fiber layers.
3. (Original) An aircraft heated floor panel as set forth in claim 1, wherein the heater level comprises a resistive element encapsulated in cured thermoset plastic plies.
4. (Original) An aircraft heated floor panel as set forth in claim 1, wherein the metal face sheet is made of a metal selected from aluminum, titanium, steel, or stainless steel.
5. (Original) An aircraft heated floor panel as set forth in claim 1, wherein the support layer includes a honeycomb layer sandwiched between fiber layers, the heater level comprises a resistive element encapsulated in cured thermoset plastic plies, and the metal face sheet is made of aluminum.
6. (Original) An aircraft heated floor panel as set forth in claim 1, wherein the underlying support/heater layers include a high temperature curing adhesive layer between the support level and the heater level.
7. (Original) An aircraft heated floor panel as set forth in claim 1, wherein the pressure sensitive adhesive is an acrylic pressure sensitive adhesive.
8. (Original) An aircraft heated floor panel as set forth in claim 1, wherein the pressure sensitive adhesive is a rubber pressure sensitive adhesive.
9. (Original) An aircraft heated floor panel as set forth in claim 1, further comprising a primer to enhance the bonding characteristics of the adhesive.
10. (Original) In combination, an aircraft and the aircraft heated floor panel of claim 1, wherein the perimeter of the lower support level is supported by a structure of the aircraft.
11. (Withdrawn) A method of making the aircraft heated floor panel of claim 1, said method comprising the steps of:

applying a layer of the pressure sensitive adhesive to the top of the heater level, placing the metal face sheet on top of the adhesive layer, curing the support/heater layers and the metal face sheet at an elevated curing temperature, and cooling the cured layers and the metal face sheet to an ambient temperature; wherein the pressure sensitive adhesive layer allows the metal face sheet to expand and contract at a different thermal expansion rate than the support/heater layers during the curing and cooling steps.

12. (Withdrawn) A method as forth in claim 11, wherein the curing temperature is at least about 250° F.

13. (Withdrawn) A method as set forth in claim 11, wherein the layer of the pressure sensitive adhesive is about 0.010 inch and wherein the curing temperature is about 280° F.

14. (Withdrawn) A method as set forth in claim 11, wherein the face sheet is cut to net shape prior to the curing step.

15. (Withdrawn) A method as set forth in claim 11, wherein a surface treatment is applied to the face sheet prior to the curing step.

16. (Cancelled)

17. (Cancelled)

18. (Cancelled)

19. (Currently Amended) An aircraft heated floor panel, comprising:
a plurality of layers cured together to form a lower support level and an upper heater level, these support/heater layers together having a certain rate of thermal expansion;
a face sheet for protecting the top of the panel from floor-traffic related damage, the face sheet having a different rate of thermal expansion than the underlying support/heater layers; and
an elastic adhesive bonding the face sheet to the underlying support/heater layers whereby the different rates of thermal expansion may be accommodated during curing procedures;
wherein the adhesive performs during elevated curing temperatures in excess of about 250° F.

20. (Original) An aircraft heated floor panel as set forth in claim 19, wherein the face sheet has a higher rate of thermal expansion than the underlying support/heater layers.

21. (Original) An aircraft heated floor panel as set forth in claim 20, wherein the face sheet is made of metal.

22. (Original) An aircraft heated floor panel as set forth in claim 21, wherein the metal is selected from aluminum, titanium, steel, or stainless steel.

23. (Original) An aircraft heated floor panel as set forth in claim 21, wherein the elastic bonding adhesive is a pressure sensitive adhesive.

24. (Original) An aircraft heated floor panel as set forth in claim 23, wherein the pressure sensitive adhesive is an acrylic pressure sensitive adhesive.

25. (Original) An aircraft heated floor panel as set forth in claim 23, wherein the pressure sensitive adhesive is a rubber pressure sensitive adhesive.

26. (Withdrawn) A method of making the aircraft heated floor panel of claim 19, said method comprising the steps of:
applying a layer of the elastic bonding adhesive to the top of the heater level;
placing the face sheet on top of the adhesive layer;
curing the support/heater layers and the face sheet at an elevated curing temperature to form a composite structure; and
cooling the composite structure to an ambient temperature;
wherein the elastic bonding adhesive layer allows the face sheet to expand and contract at a different thermal expansion rate than the support/heater layers during the curing and cooling steps.

27. (Withdrawn) A method as set forth in claim 26, wherein the face sheet is cut to net shape prior to the curing step.

28. (Withdrawn) A method as set forth in claim 26, wherein a surface treatment is applied to the face sheet prior to the curing step.

28. (Cancelled)

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